Student Assessment in the Ubiquitously Connected World

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Abstract

Student cheating on university assessments from entrance exams to finals and from contract cheating on coursework to requesting exam answers using a mobile phone during the exam, has received more and more attention of late. As connection to the Internet becomes ubiquitous and computing and communications technology more embedded in our environment, it is argued that a re-focussing on providing educational opportunities is needed in higher education, rather than chasing the ever-retreating prospect of perfect, or even adequate, assessment for the purposes of qualification.

1 Introduction

There is a common complaint amongst academics that students in higher education increasingly lack originality and turn to copying and pasting material from online sources, to attempt to fulfil requirements for various types of coursework. Essays are particularly claimed to be a target of such behaviour. As discussed by Clegg & Flint (2006) and many others the reality of any significant increase in such behaviour is difficult to prove. There is disagreement on what constitutes plagiarism and where the line should be drawn on poor practice (plagiarism is a serious piece of misconduct leading to sanctions up to and including expulsion, whereas poor practice simply loses marks and is the subject of feedback). Again as discussed by Clegg & Flint (2006) and many others, there is also a perception of an increase in other forms of cheating in coursework through the use of purchasing standard essays from online sites or buying bespoke services to satisfy courserwork requirements. This "contract cheating" aspect extends to almost any kind of work that is not performed under direct scrutiny. In computer science, for example, where significant individual programming projects are almost always a major element of study, such contract cheating has a long history, but the advent of the Internet just as it allows sellers of both rare and commonplace items to be brought together with potential buyers wanting or needing such items, can equally well put unscrupulous vendors of essay writing or coursework programming services together with the student with more money than morals. It is clear that opportunities to cheat on coursework are greater than ever, whether or not the actual occurrences are significantly increasing or not.

The experience of the author in setting essays for students on a large (150+) course on technology ethics found that essay topics which depend on the individual's experiences (personal digital profile, for example) resulted in automatically identified cases of plagiarism in very few cases (one or two per year) yet when the subject was generic and one on which a great deal of material had been written (open source software licensing, for example) approximately ten percent of the students succumbed to the temptation to copy significant material from online sources without attribution, despite training in good academic practice and reminders along with the coursework specification on both referencing requirements and the use of Turnitin to check for matches to online sources. In addition, a portfolio assignment

was discovered to have been posted to a contract cheating website with a request for a contractor to carry out the work.

Universities are now faced with severe pressure from society at large and in particular from employers to crack down on plagiarism and ensure the validity of assessments[1] so that filtering of academic achievements can be used to decide whom to interview for jobs. The more prestigious the employer, the more they demand high quality filtration information from universities.

The results of this pressure, combined with a reduction in per-student funding in many places, puts academic staff under severe pressure. If they discover and raise incidents of plagiarism it often creates questions of procedure and legality interfering with the teacher/student relationship and takes much more time than simply grading and giving feedback for the work which is presented. The author's own experience is that identifying and dealing with each plagiarism case can take up to ten times as long as marking an honest piece of work in general, even assuming no appeals, court cases etc. If staff take the easy way out and turn a blind eye to plagiarism by not using automated checking tools and not following up on the usual signs (regular change of style, odd word choices, mixed US and English spelling) they may be seen as undermining the quality mark of their own institution by allowing cheating students to graduate potentially with high marks (especially in the case of contract cheating). There is some evidence that the quality of plagiarised or contract cheating material may be relatively poor (Baty, 2005), although other surveys suggest a varied quality level is available (Jenkins & Helmore, 2006). So, the smart but lazy and unethical student is likely to use these services only for a portion of their workload, perhaps freeing up time to spend on achieving very high marks in the remaining elements.

One way that is often suggested for avoiding an impact of plagiarism and contract cheating on summative assessments is to decrease the relative weight of coursework[2], seen as more prone to plagiarism and contract cheating, and increase the relative weight of exam results in calculating final grades.

In this paper it is argued that the advent of ubiquitous networking and wearable computing mean that the day is rapidly approaching where the concept of a closed book exam will become meaningless, where the only differentiation between exams and coursework will be in the time allowed to perform the work and in the synchronicity of this time period for all students taking that exam in person. It is further argued that in such a world the efforts currently being spent by academics and school teachers on attempting to identify the various forms of cheating will become pointless and a severe distraction from their primary purpose: providing educational opportunities to those who wish to avail themselves of those opportunities. The old saw about "when you cheat in a test you are only cheating yourself" needs to become the reality of educational assessments. Formative assessments need to become the focus of educators while the role of the grade and even the diploma itself needs to be de-emphasised or even removed, as a filter to opportunity. As with many other aspects of life, computer and communication technologies will severely disrupt existing social and financial norms, but this is inevitable and the best that the teaching professions can do is to see the writing on the wall and move as a body to reassert their primary purpose: education, not qualification.

2 Qualification: Assessment as Filter

At the beginning and end of a university education there is an assumption that assessment results can be used as a suitable filter to decide who does what. In the UK in recent years, as

[1] It should be noted that schools face similar pressures, not least from universities, and universities put each other under similar pressures regarding postgraduate recruitment.

[2] As noted by Jenkins & Helmore (2006) even on courses where coursework carries no summative marks, students may be inclined to plagiarise coursework elements such as computer programs.

various political rows have shown, the issue of who gains a place at Oxford and Cambridge Universities particularly, but also the other "elite" universities of the UK,[3] has become the subject of a significant debate. The association of a degree from these universities with high levels of success for their graduates leads to an assumption that anyone who graduates from them will become a success and that failure to gain a place at such institutions (or to graduate) would significantly depress the life chances of the disappointed applicant. In response to these pressures, universities and schools have become somewhat paranoid about new technological modes for cheating. For example, instructions for invigilators at the author's previous institution included advice about checking students (particularly those with long hair or artificial head coverings) for wired or wireless mobile phone earpieces.

In the US, combinations of national tests such as SATs and the ACT, alongside school assessments via coursework and internal tests, and individual "achievements" from the CV, are used to decide on both offers of entry to courses and sometimes (particularly for elite universities) to decide on offers of some scholarships.

In Japan, national and private universities typically run their own entrance examinations, alongside or instead of the national achievement test as a filter for qualifying to take their admission test. Admission tests will usually involve two exams: a generic educational attainment exam and a subject-specific exam for more advanced knowledge of relevant types (science and mathematics for those subjects, reading and writing ability in Japanese for arts and humanities subjects, for example). The problem highlighted in this paper became a major national news story in February 2011 when it emerged that questions from the University of Kyoto[4] entrance exam about English and maths had been posted to a Yahoo! general question and answer web site, and received very swift answers, during the exam. It is posited that the questions were posted from an internet-enabled smartphone during a toilet break (Yomiuri Shimbun, 2011).

The recent development of a market economy in China has produced a focus on gaining a place at top universities, which depends on success in a set of national entry examinations. As with elite US universities, allegations (and some proven occurrences) of cheating by various means have become rife in China, leading to a number of arrests and some very tight security including CCTV, metal detection and similar technologies, within and around these exams (Hogg, 2009). The problem effects universities at the other side of the process as well, with an increase in the number of discovered cases of plagiarism and contract cheating on coursework.[5]

When taking exams himself in 2004 the author realised on a mid-exam trip to the restroom that he had in his pockets a connectable mobile phone and PDA which could access the Internet (the author stresses that he did not make use of this facility but it was within his grasp). It would now be feasible for a student to be using invisible wearable computer gear with embedded screens in glasses showing them an Internet connection. Input to such a system is a little more awkward but non-visible input devices are also feasible: everything from sensing body movement (Bellucci *et al.* , 2010) to direct brain-machine interfaces (Ortiz Jr, 2007; Cerf *et al.* , 2010) have been demonstrated, and the sophistication and capabilities of these devices are rapidly improving.

In many ways education, and in particular higher education is now mostly seen as a filter. Many employers require a degree simply to enter into any of their knowledge worker positions, particularly those at entry level. The more attractive employers have a requirement not just of a degree, but a degree of a certain classification or GPA, depending on the

[3] the "golden triangle" of Oxford, Cambridge and the two most prestigious London colleges: UCL and Imperial in particular but also including various others such as Durham, St Andrews, Edinburgh, Glasgow, King's College London etc.

[4] One of the top-ranked schools in Japan, only second to University of Tokyo in most international rankings.

[5] It is difficult to prove solely an increase in cases as it might be that better awareness and detection methods may uncover a larger proportion of a similar sized problem, or may indicate an increase in occurrences, or both together.

system. In the UK, for many students a II(i) (upper second) is regarded as the minimum required for "a decent job" with anything below that regarded as equivalent to a fail (the author has had a number of tutees over the past few years state that quite clearly). For some employers the bachelors degree has ceased to be sufficient and only a Masters level qualification will do. This is despite the attitude of many managers that what the students actually learn at university has little or nothing to do with what they will then go on to do for their employer. They simply regard it as a "rite of passage", nothing more. Being able to complete the requirements of a degree, possibly to a certain assessment result, is an indicator of their ability simply to stick to a required regimen, and a necessary indicator of sufficient general quality. A survey conducted by Reed recruitment firm, for example, showed 1,212 out of 1,263 respondents at firms preferring an individual with "the desired mindset" than one with the relevant skill set (Attwood, 2010), but still required a university degree.

3 Ubiquitous Connectivity

3.1 Wearable Computing

The days when a computer was a huge machine sitting in the basement of an office are now long gone. It is clear to anyone with even a basic understanding of technology that the latest smart phones such as the HTC Touch, the Apple iPhone or the Samsung Galaxy S are simply small computers with integrated telephone service added in. While such items are still fairly obvious when in use, there has long been research into the integration of processing, input and output devices into ordinary-seeming clothing (Nolan *et al.* , 2008). University of Toronto Professor Steve Mann has been recording much of his daily life for almost two decades now and has seen the cameras he uses for such capture shrink from a heavy head-mounted unit to something that fits comfortably and effectively invisibly into a pair of glasses. Similar developments in display technology are either here or under strong development.

Many kinds of input devices have been used over the decades since the introduction of digital computers, from switches on the front of the console for early mini-computers to light-pens providing interactivity directly with graphics on the screen. The explosion of use of PCs in the early 80s led to the dominance of a small number of devices, particularly the keyboard and mouse, with joysticks and gamepads for gaming and graphics tablets for serious computer art. The development of mobile devices and of more large scale physical gaming (particularly the Nintendo Wii console and the Kinect input system for the Microsoft X-Box 360 console) has produced an explosion of innovation in the field of input devices. For the purposes of wearable computing and invisible input, developments in glove-based chording keyboards, where very slight movements of the hands can be interpreted as input signals, are particularly interesting (Lee *et al.* , 2003). Other alternatives include various new text entry options using gestures such as UniGest (Castellucci & MacKenzie, 2008). For clandestine use, however, the one-key entry system of MacKenzie & Felzer (2010) looks particularly interesting. While severely limited in speed, its single key with time approach could as easily provide the able-bodied with clandestine input as it can open usage for the severely physically limited.

3.2 The Ubiquitous Network

Wireless communications networks are now no longer primarily used for carrying voice calls. The mobile phone, as mentioned above, is no longer primarily a phone and the networks that carry their signals are moving towards seamless integration with the wired infrastructure of the Internet, at least as far as most users are concerned. A difference in maximum speed for downloading large files is all that is apparent to most so-called mobile broadband users with

download speeds available to them which are far in excess of the common wired telephone dial-up Internet capacity in use only a few years ago.

When combined with the wearable processing and interfaces described above the advent of mobile Internet connectivity already has provided or will soon provide users, at reasonable cost, with the following capabilities:

- Send voice, text, images and video data to any other connected person without this being apparent to a physically co-located person looking at the sender. This concept was dubbed Silent Messaging [SM] by (Vinge, 2006) in his near-future science fiction novel.
- Access the web, including databases from Wikipedia to Westlaw and search engines.
- Access local or remote processing of data.

All of this using a wireless Personal Area Network (PAN), connected wirelessly to the Internet at large. The PAN+Internet is already available, in the shape of WiFi routers with 3G connections. The author uses such a system to communicate between his laptop and palmtop computers at present, and to connect both to the Internet when away from the home and office wired/WiFi networks.

4 Closed Books in a Connected World

On many courses a substantial portion of the grade awarded will be based on closed book exams. A student enters a room for a class test or an exam and is faced with unseen questions which they must answer without reference to external texts. Some courses allow one or more set texts to be taken into an exam. For example the author's own exam in EU Law allowed textbooks to be brought in — a clear acknowledgement that only someone with a photographic memory would be able to accurately reference the different article numbers of the various versions of the European Treaties (even where the text itself is unchanged, the article number often alters between versions). This also reflects actual legal practice where the volume of material available precludes anyone keeping it all in mind. The skill that is being tested is finding the correct information quickly and then using it to support a legal analysis of a specific hypothetical situation.

The debate about what is the "best" methods of assessment of educational achievement receives an annual outing in the press in the UK, alongside similar annual claims of "dumbing down" "over-assessment" and "grade inflation". One of the regular debates is about gender differences in performance in a variety of coursework types versus performance in exams (Elwood, 2010). Much less studied is any difference between performance of different groups in open and in closed book examinations.

However, the introduction of ubiquitous connectivity and wearable computing make a complete mockery of any concept of closed book exams, and of disconnection from electronic and human sources of information. We are now in the beginnings of the transition period towards a network society (Castells, 1996). Dependence on connectivity in the ordinary world abounds — dependence on online maps and GPS navigation for getting around; dependence on SNS to arrange one's social life; children's freedom to leave the family home dependent on mobile phone tracking and always answering calls from parents or explaining missed calls (Ribak, 2009). In the workplace and the home Internet access is moving from luxury to necessity for many, and is even regarded as a human right akin to water and power in Finland (BBC, 2010a). A poll by the BBC of people in 26 countries around the world conducted in early 2010 found that 79% of those questioned shared the view of Finnish legislators that Internet access now ranks alongside roads, water and power as necessities of modern life (BBC, 2010b).

In this modern world, expecting examinations to be conducted without access to the Internet begins to seem akin to requiring use of slide rules once calculators were available to all, or requiring the use of nib pens once ballpoints and rollerballs became the standard writing instrument of choice. The very act of requiring students to hand-write exams when not only is coursework allowed to be, but is often usually required to be, word-processed is beginning to seem ridiculous.

Why does education cling to the closed book exam format? One of the principle reasons would appear to be the greater difficulty of cheating in invigilated, unseen question, closed book exams, than in less time-sensitive coursework with its uncontrolled communication potential.

5 Cheating

Cheating comes in many forms but it all boils down to the same thing in the end: gaining a higher assessment than the combination of ability and performance of the student could achieve in the time and setting allowed. In recent years, the focus on student cheating has mostly focussed on increases in two of the most common form of cheating on coursework: students sharing part of all of their work on an assessment supposedly done individually; students copying material from digital sources and (possibly with minor edits) submitting it as their own work. More recently the issue of contract cheating, students paying someone else to produce some or all of a submission, has also been identified as a growing issue. A number of technological factors have contributed to these issues.

Students sharing work has become easier and quicker with the advent of word processing as the normal mode of submission. Quick and simple editing of electronic files shared between students allows them to share work just before a deadline, involving far less time and effort than the previous requirement to re-write a shared piece long-hand. Cracking of other students accounts to obtain their submitted work is the technological equivalent of fishing it out of the submission box.

Access to the Internet and the proliferation of good search engines and free content sites such as Wikipedia (alongside Universities' broad purchase of access to databases of academic and journalistic articles) has given students the possibility to simply copy-and-paste material. Without even the necessity of re-typing source material, the paraphrasing and referencing that in earlier times typified good academic practice now seems like too much work for the lazy student compared to two clicks of the mouse and a couple of keyboard shortcuts. Many students even appear to lack sufficient understanding of text formatting to be able to copy just the text and place it into the same style as the surrounding work, making manual detection of such practices easier.

Just as the Internet has put buyers and sellers of obscure collectibles together through ebay and those with obscure hobbies together through web sites and SNS, so too has it provided a simple way for students wishing to cheat to find those offering to help them for a fee or for free. "Expert guidance" sites, "example essay" sites and sites unashamedly offering contract cheating all abound online, while the general question and answer sites such as that used during the Kyoto University entrance exam mentioned in the introduction allow the crowdsourcing of answers to specific questions potentially very quickly (Yomiuri Shimbun, 2011). The author and artist behind the popular online comic Piled Higher and Deeper, for whom advertising on his website provides a significant element of his income, spends a significant amount of effort on ensuring that contract plagiarism sites are not advertised on his site.

5.1 Academic Efforts to Detect and Punish Cheating

Academics used to rely on their own knowledge of the corpus of their subject to detect unreferenced quotes and on the their own easy recognition of common material between the work of multiple students. The rise of the Internet gave students access to a much broader range of sources, often beyond the "pure" academic literature relied upon and well-known by the academics. Indeed it is difficult these days for an academic to have read and recognise all of the relevant academic literature available on the subjects they are teaching, or perhaps even in their own research field. The increase in student numbers and the use of graduate students and post-doctoral research staff to grade papers, perhaps parcelling out hundreds of essays amongst multiple markers, have also undermined this approach. Just as technology created greater opportunity for copying, it was thought that perhaps it might also provide the solution. Thus plagiarism checking services such as Turnitin were developed and are now marketed to Universities singly or en masse either as separate services or as part of the virtual learning environment. Beyond simple checking of every item uploaded against a range of sources (freely available online sources, some access to databases of published information and previous and contemporary student submissions) these systems are now offering a range of allied services including grade return and feedback systems as well as attempts to automatically distinguish between plagiarism and judicious referenced quoting.

Unfortunately for academics the automated elements of these systems, although far better than manually checking suspect sentences in a manual web search, still require significant work by the academic to decipher the difference between high quotation rates, use of common sources, properly referenced work and shared or copied plagiarism.

In addition, it is clear that some students are becoming more sophisticated at doing just enough work to avoid the identifications of these systems. In some cases, the work done to avoid detection might seem to academics rather pointless and that students should be simply doing the work properly. Nevertheless students are now turning to plagiarism checking services themselves to pre-screen their essays before submission. In some courses, this is in fact encouraged as a way of helping students to develop appropriate writing skills and to identify to them before submission where their work might be overly dependent writing and where references, quote marks or further paraphrasing is needed. Others see it as simply the next level of cheating, however, as suggested by the China Daily (2011).

It is not only students who have themselves copied material who are using these services, but those who are purchasing bespoke essay writing and who wish to avoid accusations of online copying done by those paid to produce work on their behalf (and perhaps leading to being hung for a lamb when stealing a sheep). These kinds of concern by the purchasers of bespoke cheating services are no doubt increased by reports such as that by Baty (2005).

These efforts to detect cheating are backed up by a number of different processes. Classes which teach students good academic practice and what the difference is between quoting or paraphrasing, when to reference and when to include in a bibliography, etc. are now part of many courses. Once work is handed in, if automatic and/or manual systems detect possible cheating, significant efforts are undertaken to provide a rigorous investigation and clear guidelines for feedback and punishment. AN overly legalistic development in the relationship between students and lecturers, partly the result of the importance of the grades delivered in deciding life chances, mean that any failure to deal with allegations of cheating with clear evidence and meticulous documentation will be used by students as an excuse for long drawn out campaigns to have unjustified marks re-instated. In the author's experience few students will ever own up to their misdemeanours without overwhelming evidence and even then many are unwilling to learn properly from their mistakes and seek merely to avoid detection, not commission, in future.

All of this takes time and effort far out of proportion to the benefit to the individual student, the institution or society, except where students manage to obtain inappropriate marks. Such is the effort now placed on educating students in good practice, that only

those who will not or cannot understand the concepts of good academic practice (and if they cannot they surely do not deserve good marks any more than if they will not).

6 Education and Feedback

What is the role of educational establishments such as schools and universities? The industrial era first brought about the need for mass education of children by increasing the demand for literate workers and providing the means of educating them (cheap printed books) (Vincent, 2000). The instrumentality of education as purely a means to providing the skills to the potential workers of the knowledge economy, is clearly a major theme in current education policy worldwide. The recent proposals for the UK government to withdraw direct state support for arts and humanities degrees, although opposed by many academics who argue for a more enlightened attitude to higher education as a social good (Pillay, 2010), is indicative of this instrumentalist mindset.

However, even the exact skills that a higher education is supposed to impart are not clearly agreed upon by government, business and educators, and there is often a tension, sometimes an irreconcilable difference, between particular demands and either the reality of educational processes and what they can achieve or student attitudes and practices. Consider the demands from employers for greater team-working experience by students (Fearn, 2008). This is at odds with the expectation from employers that students' grades reflect only individual effort (so as to act as a filter) and the difficult if not impossible task of allocating marks separately to members of a group.

Educational assessment is broadly split into the binary category of formative or summative assessment (Gibbs & Simpson, 2004–5). High quality education in most fields of higher education requires reflection by the student on their current ability, provided by formative assessment. Summative assessment ideally has very similar requirements for activity by students to formative assessment. Ideally the difference is only in the format of the result. Summative assessment can be dealt with more quickly and easily since the goal is a summation of student ability rather than detailed feedback on flaws in approach or application. Formative assessment is a key part of learning. Summative assessment is a useful indicator that a students is ready to move on to other things. This utility of summative assessment, however, has been diverted into a filter for external users rather than for the student. In doing so, it produces a rational reaction on behalf of students to at least game the system (concentrating on elements of the education which lead to high marks in summative assessment) and at worst to cheating of various forms in an attempt to pass through the filter, seen as an unfair barrier to progress. The lack of respect shown to real education by business people mentioned above, contributes to a tendency by students to regard cheating as acceptable. If the actual educational content does not matter and only passing the filter barrier matters then the methods of passing that barrier also do not matter to students. This is exactly the kind of reflective approach that educators seek to instill in students regarding their studies, but the current system leads that reflection to result in poor attitudes to education and cheating.

The time currently spent by educators in dealing with the formal processes of plagiarism would be better spent on providing feedback to the students on how to perform the appropriate task themselves, without recourse to blind copying and pasting. The author's experience is that dealing with the formalities takes much longer than appropriate feedback and teaching of good practice. For students who insist on continuing to plagiarise, educators can eventually simply point students to the earlier material and suggest that students need to follow the learning process once again. Only where assessment has summative external filtration purposes do formal processes need attention.

7 Social Inequalities and Recruitment Practices

If results continue to be used as a filter, then those who are willing and able to cheat will be provided with an advantage. In the short term, the technology to perform such cheating will be relatively expensive, but not out of reach of students for very long. The benefits of coming from a higher income family more able to afford technology such as a fast Internet connection at home is known, although other factors such as parental engagement in education processes, also count for a great deal. If nearly-impossible to detect plagiarism becomes possible but expensive it is yet another non-meritocratic nail in the coffin of social mobility.

8 Conclusions

de Jager & Brown (2010) reports that academics at the University of Cape Town found the formal legalistic procedures to be "unrealistic" and dealt with suspected student plagiarism themselves informally. The author's own experience is that dealing with a case of suspected plagiarism under a formal process typically takes at least twice as long in the best case scenario as marking a piece of work normally, and in the worst case can involve long drawn out processes possibly resulting in the expulsion of the student concerned.

As we approach a world of ubiquitous networking and processing, now available in one's pocket with a smartphone or netbook and soon available through a PAN and invisible wearable processing, input and display technologies, the closed book exam has had its day. Crowd-sourcing of everything from essays to computer programs, combined with a lack of funding for direct supervision of lab experiments, make coursework equally untenable as a source of accurate grading. Before its role as a quality filter collapses under its own weight, bursting the higher education bubble based on diplomas as gateways to desirable positions, education at all levels, but particularly higher education, must put its own house in order and refocus its efforts on providing a meaningful educational opportunity to students, whose responsibility it is then to make the best of that opportunity.

The Yale Law School perhaps offers a template for the future of higher education, although the nature of the subject, the school and the University make it difficult to see how this successful model could be generalised for a mass education system. Yale Law School is relatively small, attracts highly qualified staff who usually continue to work professionally in parallel with their academic duties teaching graduate-only students, at a relatively well-funded private university with a very good reputation. The Yale Law School model involves much broader consideration of applicants than LSAT (Law School Admission Test) and undergraduate GPA, stressing community involvement and service amongst other desirable traits and activities. Once attending the school the curriculum is highly personalisable and involves engagement with professors' research, law clinic activities and self-motivated working. The outcomes of assessment on modules consist of broad grades of Honors, Pass, Low Pass and Fail. No numeric aggregation is performed for final graduation, simply a requirement for sufficient credits at Low Pass or better. The final results consist of a list of grades for modules. Their web site (`www.yale.law.edu`) claims that individual traits count for more than these broad grades (though acknowledging their remaining utility as a filter mechanism for potential employers).

Assessment needs to be presented to students as a seamless element of their educational progress, a marker for them to use to guide their further studies, and designed accordingly. No longer should tests be artificially skewed to measure what can be measured simply to provide a poorly-justified numeric measure of students' quality for external consumption. Instead, tests should be aimed at providing students solely with an evaluation of their understanding of the concepts and methods necessary to move on to the next stage of their learning. Employers need to find ways of assessing employment candidates more broadly,

and resign themselves to the mass application system just as universities have had to resign themselves to the mass education system. The Internet shrinks the distances between people, and the downsides of this are spikes in interest which can overwhelm processes designed only to cope with small numbers. This is the reality of the knowledge economy and the network society. Requiring education to continue to act as filter in this environment is the knowledge economy eating its own young, rather than nurturing them to succeed.

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